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Proceedings of the Pacific regional peer review on Review of the Information for the Identification of Critical Habitat for Morrison Creek Lamprey

October 29, 2013
Nanaimo, BC

Chairperson and Editor: Chrys Neville

Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, BC V9T 6N7

October 2016

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

These proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Advisory Process on October 29, 2013 at the Pacific Biological Station in Nanaimo, B.C. One working paper focusing on the Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni* var *marifuga*) was presented for peer review.

In-person participation included DFO staff from Science branch and SARA. Representatives from the province of BC and NGO's also participated

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report providing advice to the species at risk program to inform listing decisions under the *Species at Risk Act* (SARA) and subsequent recovery planning activities.

The Science Advisory Report and supporting Research Document will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

Compte rendu de l'examen par les pairs de la Région du Pacifique sur l'Examen de l'information servant à la désignation de l'habitat essentiel de la lamproie du ruisseau Morrison

SOMMAIRE

Le présent compte rendu résume les discussions et les conclusions clés du processus de consultation régionale du Secrétariat canadien de consultation scientifique de Pêches et Océans Canada qui a eu lieu le 29 octobre 2013 à la Station biologique du Pacifique à Nanaimo, en Colombie-Britannique. Un document de travail portant sur les renseignements à l'appui de la désignation de l'habitat essentiel de la lamproie du ruisseau Morrison (*Lampetra richardsoni* var *marifuga*) a été présenté aux fins d'examen par les pairs.

Des employés de la Direction des sciences ainsi que des employés de Pêches et Océans Canada responsables de l'application de la *Loi sur les espèces en péril* participaient en personne à la réunion. Des représentants de la Province de la Colombie-Britannique et d'organismes non gouvernementaux étaient également présents.

Les conclusions et avis découlant de l'examen prendront la forme d'un avis scientifique destiné au programme des espèces en péril et visant à éclairer les décisions d'inscription sur la liste de la *Loi sur les espèces en péril* et les activités de planification du rétablissement correspondantes.

L'avis scientifique et le document de recherche à l'appui seront rendus publics sur le site Web du calendrier des avis scientifiques du Secrétariat canadien de consultation scientifique.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Advisory Process (RAP) meeting was held on October 29, 2013 at the Pacific Biological Station in Nanaimo to review the information needed to identify critical habitat for the Morrison Creek Lamprey (*Lampretra richardsoni* var *marifuga*) as described under SARA. The Morrison Creek Lamprey is listed as Endangered in Schedule 1 of the Species at Risk Act. As such, critical habitat for the species must be identified in the Recovery Strategy or Action Plan based on the best information possible.

The Terms of Reference (TOR) for the science review (Appendix A) were developed in response to a request for advice from the Species at Risk program. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from First Nations, the province of British Columbia and academia.

The following working paper was prepared and made available to meeting participants prior to the meeting:

Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni var. marifuga*) by Joy Wade, Nadine Pinnell Gabrielle Kosminder and Sean MacConnachie (CSAP Working Paper 2013/14 P34).

The meeting Chair, Chrys Neville, welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair discussed the role of participants, the purpose of the various CSAS publications (Science Advisory Report, Proceedings and Research Document), and the definition and process around achieving consensus based decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference and working papers.

The Chair reviewed the Agenda (Appendix B) and the Terms of Reference for the meeting, highlighting the objectives and identifying the Rapporteur for the review. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation.

Members were reminded that everyone at the meeting had equal standing as participants and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 14 people participated in the RAP (Appendix C). Julia Bradshaw was identified as the Rapporteur for the meeting.

Participants were informed that Dr. Richard Beamish had been asked before the meeting to provide detailed written reviews for the working paper to assist everyone attending the peer-review meeting. Participants were provided with copies of the written review. Jordan Rosenfeld also provided a written review and the agenda was modified to provide time for him to present his specific comments.

Nadine Pinnell (DFO-SARA) provided an overview of the how SARA defines critical habitat and what items must be considered. She indicated that the goal of defining critical habitat is to prevent wildlife from becoming extinct. Critical habitat is both the area and the biophysical features that are required and must be based on the best information available at the time. Geographic area includes key features including pools, ripples, riparian vegetation, water quality that are required to support the biological functions of the species. The features can have qualitative or quantitative attributes. Ms. Pinnell provided examples of approaches that could be

taken to identify the geographic area including the area of occurrence, the bounding box approach and the critical habitat parcel approach. She explained that recommendations for additional studies for information that is unknown and that identification of activities that would likely destroy critical habitat were important components that should be included in the document. She indicated that these could be either specific (if known) or general. Ms. Pennell also indicated that it was important to determine if Residence applies to Morrison Creek lamprey as Section 22 of SARA prohibits the destruction of residence. Residence is a dwelling place, supports a life cycle function, requires a level of investment in the structure and must be occupied by one or more individuals. If residence applies to the Morrison Creek lamprey the location, time of year, and period of occupation should be indicated using the best .information available.

The Chair reminded the members that the conclusions and advice resulting from this review will be provided in the form of Science Advisory Report to the Species at Risk program to inform species at risk recovery planning. The Science Advisory Report and supporting Research Document will be made publicly available on the CSAS Science Advisory Schedule.

REVIEW

Working Paper: Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni var. marifuga*) by Joy Wade, Nadine Pinnell Gabrielle Kosminder and Sen MacConnachie (CSAP Working Paper 2013/14 P34).

Rapporteur: Julia Bradshaw

Presenter: Joy Wade

PRESENTATION OF WORKING PAPER

The author reviewed the taxonomy of the Morrison Creek lamprey, the limited information known on abundance and the potential for habitat fragmentation within the watershed. The author noted the following:

- Morrison Creek lamprey, is believed to be one complex of animals that produces two life history forms These are considered to be paired species with different life history modes (parasitic or non-parasitic). Morrison Creek is the only known living example of this and is therefore key to understanding how they adapt or evolve.
- There is no estimate of abundance for the Morrison Creek lamprey however based on in stream surveys, catch of the metamorphosed Morrison Creek lamprey in 2013 was only 10% of the numbers observed in the 1980s.
- Habitat fragmentation could be caused by obstacles in the river and since the animal is small the obstacles do not need to be large. Three possible barriers identified including culverts under the Comox logging road and under 1st Street and a v-notched salmon weir. The author indicated that these needed to be remediated to allow passage by the lamprey.

Questions for clarification

The V-notched weir put into the creek in the 1980s to create a spawning channel. However, it has downcut since that time and can now also be a barrier to salmon depending on water flow and needs to be addressed.

It is unlikely that there are isolated populations upstream of the barriers as there would be no limit to downstream movement. However, it is not known if removal of the barriers would have an impact on anything else upstream.

No information known in regards to impact upstream although it is likely that if lamprey upstream the juveniles would be swept downstream during higher flow periods.

Are beaver dams barriers? They come and go over time.

The role of beaver dams to creating structure within the river or being a barrier to lamprey movement is not known although lamprey have ability to slide through many structures dependent on the specific structure and water movement..

WRITTEN REVIEWS

Dr. Richard Beamish gave his presentation (see Appendix D). He included some background information on the discovery of Morrison Creek lamprey and the importance of it as a paired species and to understand lamprey evolution. He recommended more emphasis on the decline in relative abundance of the lamprey since the 1980s. He also recommended that Maple Lake as a potential ground water source for Morrison Creek be included in the report. He mentioned new research using DNA analysis that may be provide differentiation between the species would be available in the near future.

Response: The authors agreed that if there was need to know about the source water to Morrison Creek although indicating that maintaining a supply of fresh cold water was critical attribute would help protect all sources.

Jordan Rosenfeld provided a second written review. This review was not received prior to meeting but time was provided for its presentation (see Appendix D). He suggested more detailed descriptions of the stream including additional photographs if available. He also recommended using an accepted methodology to identify the width of riparian widths.

Response: Authors indicated they would do their best to add more stream specific information including water quality parameters. They indicated they would review information from participants on some habitat inventory mapping that had been previously done on the system. They authors suggested they include in the document a riparian buffer of 10-30m but recommend that further work be conducted using a sound and published methodology such as RAR. It was agreed that this would be included as a recommendation for future work.

GENERAL DISCUSSION

The limited information on abundance and biology of the Morrison Creek lamprey and limited information on the specific biophysical characteristics required by the lamprey dominated the discussion. Major points included

Hydrology of system poorly understood. Potential of Maple Lake or Comox Lake being source of water for the system should be mentioned in paper. Need to improve understanding of source water and continual supply of cool fresh water must be included.

Poor understanding of the relationship of Morrison Creek lamprey with it paired non parasitic Western Brook lamprey. Due to this limited understanding both forms within the system must be protected.

Lack of information on what both adult and juveniles form of Morrison Creek lamprey are feeding on.

It was suggested that the activities likely to destroy critical habitat had to be less general and more specific. For example talking about forestry encompassed to many activities and is not specific enough. Be more specific. An example could be "unmitigated forestry issues that result in sedimentation of creek".

Recommendation was made to provide more historic information on mining and forestry be included in the document. It was noted that most of this information should have been in Recovery Strategy and that could be referred to from that previous document and that the focus here should be on specific actions that could be taken in response to current conditions. Debate continued on the level of information that should be included in the document. It was agreed that some wording indicating that "activities likely to disrupt the stable hydrology and affect the water supply and storage associated to the head water wetlands" be identified as am activity that could cause harm.

There was discussion on additional information that could be added to the biophysical attributes. This could include both photos or physical descriptions of the features but should help make the link between the feature and its function.

Other knowledge gaps included potential influence on the creek by the Pigeon Landfill, obtaining continued communication with the city of infrastructure work that may be undertaken and the need for additional biophysical information on the system,

Non-lethal monitoring methodologies were discussed including trapping. It was emphasized that the impact of handling the animals was not known and we could do more harm. The potential of DNA identification in the future and the need for additional genetic samples was discussed.

It was recommended that the bounding box approach to identifying critical habitat be used. This approach would draw a line around the whole area and identify specific features that are important within that area.

CONCLUSIONS

The paper was accepted with minor revisions.

RECOMMENDATIONS & ADVICE

Based on the best available information the entire wetted area, channel and headwaters of Morrison Creek and its tributaries is recommended as critical habitat for the Morrison Creek Lamprey. This is the area that contains the critical habitat features and attributes that are necessary to support the life history functions of the Morrison Creek Lamprey. The participants highlighted the importance of the upper headwaters for maintaining water flow, quality and storage. A hydrology study to examine the relationship between water sources and discharges from the system was recommended.

A riparian zone of 10 to 30 m, as determined by the RAR methodology, was recommended as forming a portion of critical habitat for the Morrison Creek Lamprey. The vegetation in this zone is critical habitat feature that supports the structure and function of the stream habitat and life history functions of Morrison Creek Lamprey. An analysis using the methods from the RAR process will be undertaken and resulting map will be provided to the SARA Program.

Residence for Morrison Creek Lamprey includes the nests that Morrison Creek lamprey construct within the Morrison Creek watershed while they are being used for spawning or egg incubation.

ACKNOWLEDGEMENTS

The chair wishes to acknowledge and thank the authors for their hard work, Dr. Richard Beamish for his review, and the active engagement of the participants to improve the quality of the scientific advice. Also, thanks to Lana Fitzpatrick of the CSAS office for coordinating and arranging meeting logistics. Thank you to Julia Bradshaw for being the Rapporteur.

APPENDIX A: TERMS OF REFERENCE

Review of the Information for the Identification of Critical Habitat for Morrison Creek Lamprey

Regional Peer Review – Pacific Region

October 29, 2013
Nanaimo BC

Chairperson: Chrys Neville

Context

The Morrison Creek lamprey is a unique life history form of the Western brook lamprey (*Lampetra richardsoni*) that is believed to occur only in Morrison Creek, Vancouver Island (Beamish 1985). It was discovered in 1977, is considered a derivative of *L. richardsoni* and has been labelled *L. richardsoni* var. *marifuga*(Beamish 1987). Its extreme endemic distribution is the principal factor in its designation as "endangered," and suggests that it will always remain at some risk.

A variety of factors threaten the Morrison Creek lamprey and its associated habitat. The primary threat is impacts associated with urbanization of the watershed. Morrison Creek lamprey was listed in 2003 as Endangered under the *Species at Risk Act* (SARA), and a recovery strategy for the species was completed in 2007 (National Recovery Team for Morrison Creek Lamprey 2007). A recovery strategy or action plan must identify an endangered species' critical habitat, or "the habitat that is necessary for the survival or recovery of a listed species and that is identified as the species critical habitat in the recovery strategy or action plan for the species". Under SARA s41(1)(c) a species' critical habitat must be identified to the extent possible, based on the best available information.

The Fisheries and Oceans Canada SARA Management Program has requested science advice in support of the identification of critical habitat and residence, and development of the Action Plan for the Morrison Creek Lamprey under SARA.

Objectives

The following working paper will be reviewed by meeting participants:

Wade, J., MacConnachie, S., and Pinnell, N. 2013. Recommendations for the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni var. marifuga*). CSAP Working Paper 2012/PXX.

The working paper will be used to provide advice with respect to the following objectives:

- Provide the best available information regarding the geospatial extent and the biophysical attributes, features and functions of the habitat necessary for the survival or recovery of Morrison Creek in Canadian Pacific waters.
- Provide the best available information regarding residence for Morrison Creek Lamprey.

Expected Publications

- CSAS Science Advisory Report (1)
- CSAS Research Document (1)
- CSAS Proceedings

Participation

- DFO Science, Ecosystem Management Branch, Species at Risk, Policy and Economics
- Province of BC
- Non-governmental organizations
- City of Courtenay
- Other Stakeholders

References Cited

National Recovery Team for Morrison Creek Lamprey. 2007. Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni* var. *marifuga*) in Canada. *Species at Risk Act* Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa. v + 24 pp.

APPENDIX B: AGENDA

Regional Peer Review (RPR)

Centre for Science Advice Pacific

Review of the Information for the Identification of Critical Habitat for Cowichan (Vancouver) Lamprey

Oct 30, 2013

Pacific Biological Station
Nanaimo, British Columbia

Chair: Chrys Neville

Time	Subject	Presenter
9:00	Welcome, Introductions, & Housekeeping	Chrys Neville
9:15	CSAS Overview & Meeting Procedures	Chrys Neville
9:30	SARA Critical Habitat (review for new RAP Participants)	Nadine Pinnell
10:00	***Break***	
10:15	Presentation of Working Paper (Cowichan Lamprey)	Sean MacConnachie
10:45	Reviewer #1 comments & Author Response	Chrys Neville
11:15	Group Discussion to review working paper	RRP Participants
11:45	***Lunch Break***	
12:45	Group Discussion to review working paper	RPR Participants
2:00	***Break***	
2:15	Review of Science Advice Report	RPR Participants
4:00	***Adjournment***	

APPENDIX C: PARTICIPANTS

Last Name	First Name	Affiliation
Beamish	Dick	DFO Science Emeritus
Bradshaw	Julia	DFO Science
Brown	Tom	DFO Science
Curtis	Janelle	DFO Science
Davies	Dave	DFO Ecosystems Management Branch
Flostrand	Linnea	DFO Science
Hargreaves	Marilyn	Centre for Science Advice Pacific
MacConnachie	Sean	DFO Science
MacDougall	Lesley	Centre for Science Advice Pacific
Neville	Chrys	DFO Science
Pinnell	Nadine	DFO Species at Risk Act
Palmar	Jim	Morrison Creek Stream Keeper
Pennell	Bill	Vancouver Island University
Rosenfeld	Jordan	UBC / BC Ministry of Environment
Wade	Joy	Fundy Aqua

APPENDIX D: WRITTEN REVIEWS

REVIEWER: DR. RICHARD BEAMISH

DFO Scientist Emeritus

CSAS Working Paper: 2013/14 P34

Working Paper Title: Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni var. marifuga*).

General Comments

This is a nicely written, comprehensive description of the habitat that is critical for the life history stages of the Morrison Creek lamprey. No one understands exactly what the Morrison Creek lamprey is, making it difficult for the authors to fit a standard assessment to the animal. The Morrison Creek lamprey is most likely a subspecies of *L. richardsoni* or *L. ayresii*. Originally it was considered to be closer to *L. richardsoni*, but recent DNA studies (not yet published) appear to show that it is closer to *L. ayresii*. The Morrison Creek lamprey is the only known example of what could be considered to be an "intermediate species" between *L. ayresii* and *L. richardsoni*. The recent Technical report (Beamish 2013) identifies why the Morrison Creek lamprey is a subspecies and no longer considered to be a variety. This report also shows that the population of the subspecies has declined over the past 25 years to a critically low level. The decline could be natural or could be a consequence of loss of critical habitat. If it is critical habitat, it may be a restriction of movement of the metamorphosed "silver form". This is speculation that could be included in this report. It is not speculation that Morrison Creek lamprey abundance has diminished substantially during a period that the Island highway was built and alterations were made to habitat that this report considers to be critical.

Although this is a report of critical habitat, it is necessary to improve the understanding of the taxonomy of the species being protected. An important part of the understanding is the analysis of the DNA of the very small mature lamprey in Morrison Creek that spawn at the end of April and May and are presumed to be "true" *L. richardsoni* . As part of this DNA study, it would be necessary to sample *L. richardsoni* from other locations for comparison.

Specific Comments (By Page, Section and Line)

Page 1

- **Para 1, Line 4.** Change "in that" to "as"
- **Para 2, Line 5.** Is Arden Creek part of the Morrison Creek watershed and if so, introduce this before this sentence.
- **Para 3, Line 6.** Explain how it was designed "for coho salmon"

Page 2

- **Para 1, Line 4.** Change 1980's to 1980s
- **Para 4, last line.** The Morrison Creek lamprey needs to be explained before this sentence. It is best to omit the text

Morrison Creek lamprey section

- **Line 3.** There is now a reference that identifies the Morrison Creek lamprey as a subspecies. This issue should be reported. It would be acceptable to continue to use the

variety classification, but the reader and the public need to know that there is evidence that it is most likely spawning.

- **Line 3-4.** What life history forms are less common?
- **Line 7.** add that the period "may be 3-7 years, but this is an educated guess"

Page 3

Morrison Creek lamprey section cont.

- **Line 1.** from July to September
- **Line 1.** We do not know if *L. richardsoni* spawn as late as July. Some spawn in July, but they could be the variety.
- **Line 3.** Change "believed" to "reported"
- **Line 4.** Change "labelled" to "designated"
- **Line 6-7.** Technically, there is a period of about four weeks when the teeth of *L. richardsoni* remain sharp
- **Line 6.** The teeth would not be "worn" as they are not used. A good term is "obsolete"
- **Line 7-8.** We only know about the feeding in the laboratory. The silver form is found as late as August and most likely lives one more year in Morrison Creek
- **Line 9-10.** *L. richardsoni* is silver for about four weeks after metamorphosis is complete
- **Line 11-12.** It is not just Canada. It is important to report that this is the only example known (in the world)
- **Line 13.** There is a paper published that used electrophoresis. Please avoid the citation for the recent DNA results. These results are important as they confirm the earlier electrophoresis results, but they need to be published. You could report the preliminary results, but not as a personal communication.
- **Line 13-14.** There are a number of hypotheses and this is one. If you want to retain the text you will need to cite Yuson and some of the earlier publications.
- **Line 15-17.** This is a critical statement. We know from an unpublished DNA study that there is virtually no difference between the species and subspecies. We also know that the combined two types are as different as *L. ayresii* is from *L. richardsoni*. Consequently, it is impossible to distinguish the species and subspecies. It has also been proposed that the species produces the subspecies. The relevance is that we use life history type as a taxonomic character and as long as this remains valid, the Morrison Creek lamprey must be regarded as a distinct and rare life history type and a distinct subspecies.
- **Line 19-20.** Change *marifuga* variety to variety *marifuga*

Population and Status section

- **Line 1.** You need to be consistent and either use "variety" or "Morrison Creek lamprey" but not "form"
- **Line 2.** Population estimates are not possible, but if we can guess the age of ammocoetes we can guess the population size. A guess is that the numbers are in the low 100s and definitely not in the 1000s. This is a very important guess

- **Line 5.** The numbers have declined substantially

Key Life Stages section

- **Adult and Metamorphosing.** This paragraph needs to be rewritten to be clear about the habitat for the Morrison Creek lamprey. We did publish a paper that identified the capture of about 5 metamorphosing lamprey. One of the 5 turned out to be Morrison Creek lamprey. Thus, the ammocoetes of both life history types have been found in the same area.
- **Spawning lamprey, Line 4-5.** We have never observed Morrison Creek lamprey spawning in the creek. We have seen *L. richardsoni* spawning and it is most likely that they behave similarly.

Page 4

Key Life Stages section cont.

- **Line 2-3.** The meaning of the sentence is not clear

Page 5

Information Sources section

- **Line 1.** Actually, there are a large number of references see Youson 2004, Beamish 1987
- **Line 10.** Change 1980's to 1980s

Approaches for Addressing Unique Life History section

- **Para 1, Line 3.** Change the *marifuga* variety to variety *marifuga*
- **Para 1, Line 3-4.** What is "the typical variety of lamprey in Morrison Creek"
- **Para 1, Line 3-5.** It is important to be sure that the reader knows that there are not distinct types that remain separate, but a population that most likely produces the two types. Because it is not possible to distinguish the two types genetically, it must be assumed that there is interbreeding. This means that the entire population needs protection.
- **Para 1, Line 7.** Avoid the use of "typical form" and specify *L. richardsoni*
- **Para 1, Line 9.** They are not "both varieties" but you could use the "life history types". I suggest you call them *L. richardsoni* and the Morrison Creek lamprey.
- **Para 1, Line 11.** Avoid "typical variety of lamprey"
- **Para 1, Line 11-12.** Change "are not believed" to "do not"
- **Para 1, Line Line 12-13.** The meaning is unclear
- **Para 2, Line 2.** Cite Yuson 2004
- **Para 2, Line 5-6.** We know that there has been a significant decline in abundance and the recent Tech report is citable.

Page 6

Approaches for Identifying Geospatial Extent section

- **Para 1, Line 8-9.** Meaning is not clear
- **Para 2, Line 1-2.** It is most important that everyone knows that the abundance is critically low. Use Tech report as a citation

- **Para 2, Line 4-11.** This reads like the Morrison Creek lamprey is separate from the population of *L. richardsoni*, yet previous arguments are that it is one integrated population

Page 7

Biophysical Function section cont.

- **Line 1-2.** It is possible that the outlet of the lake is underground and is a source of water for Morrison Creek.

Page 10

Stream Habitat- ammocoetes section

- **Line 4-5.** This infers that there are reliable estimates for other species of lamprey which is not correct.

Stream Habitat- adult feeding section

- **Para 1.** It is important to report that the Morrison Creek lamprey (silver stage) actively migrates within the Creek. We could guess that it is searching for prey.

Page 11

Stream Habitat- spawning section

- **Line 10-11.** We have seen lamprey spawning and building nests

Page 13

Residence section

- **Para 2, Line 1.** We do not know this, but we know that *L. richardsoni* does this and the population that produces the Morrison Creek lamprey would do this
- **Para 3, Line 5.** (western brook lamprey) It is better to be consistent and use either the common name or the scientific name. I prefer the scientific name.
- **Para 4, Line 1.** Add Figure number

Page 14

Residence section cont.

- **Para 1.** This information is repeated several times
- **Para 2.** We found larger, mature lamprey into July and August. The smaller lamprey that are less than 110 mm appear to spawn much earlier. I consider that the smaller lamprey were the true *L. richardsoni*. The larger spawning lamprey were found much later. It is possible that the larger, mature lamprey are the lamprey that produce the Morrison Creek lamprey.
- **Para 3, Line 3.** I forgot the name of the lake but it is believed to be an underground source of water for Morrison Creek. There is no known outlet, so it is assumed to be underground.

REVIEWER: JORDAN ROSENFELD

BC Ministry of Environment

CSAS Working Paper: 2013/14 P34

Working Paper Title: Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni var. marifuga*).

Overview

This lamprey critical habitat assessment presents a good synopsis of current information on biology and habitat associations to inform designation of the habitat that needs to be identified to protect Morrison Creek lamprey under SARA. Overall recommendations appear generally sound. However, there are some areas that require clarification, better rationalization of conclusions, or clearer descriptions of methods use to arrive at particular inferences. These include:

1. More basic information on physical habitat of the stream would be helpful, i.e. channel size, average substrate type, average gradient, and the degree to which spawning habitat may be limiting (if known).
2. Clearer reference to recovery targets identified in the recovery strategy, ideally near the start of the document. The area or quantity of habitat identified as critical depends on the recovery goals and target, i.e. a 200% larger population recovery target may logically need twice as much habitat. While the current rationalization of the area of critical habitat required hits the main points, it could be strengthened.
3. Clearer justification for why riparian should be included as critical habitat, with particular reference to vulnerable life stages or aspects of the biology of lamprey.
4. Clearer rationalization of how the RAR was used to arrive at a 10m buffer width. Buffer widths under the RAR methodology depend on the attributes of a reach, and are consequently rarely constant along the length of a channel.
5. These issues are considered in more detail below.

Major Comments

1. Try to include more basic detail on physical habitat structure of the stream

A bit more detail on the physical habitat structure of Morrison Creek would be useful. The physical habitat attributes of the channel really determine the habitat that is available to lamprey and what may or may not be limiting, so a better quantitative description would be useful. More specifically, what is the average gradient of the stream (perhaps in the different discrete reaches)? How may this affect the distribution of spawning habitat? What is the average annual discharge? Minimum summer flows? Average substrate size? Is spawning/riffle habitat likely to be limiting anywhere (i.e. in the headwater areas?).

For a reviewer or reader who has not seen the stream, it is difficult to impossible to get a feel for what the habitat is like without this additional information; including a couple of digital photographs of representative habitat in the different reaches would be helpful and appropriate. The authors do give a channel width of 2.2-6.2m. I checked out a few pictures on the web that looked somewhat wider than that. This detail becomes important for applying the RAR methodology (see below).

A comment on descriptors of substrate – silt is generally understood to be very fine inorganic material. What the authors are referring to as "mud" is (presumably) fine organic matter, and this should be clarified (the distinction being that amocoetes can feed on fine organics but presumably not fine inorganics).

2. Better rationalization of area of habitat identified as critical.

Logically, the extent (area) or habitat identified as critical depends on the population and distribution recovery targets (see points number 5, 6, and 10 in the DFO 2008; and Rosenfeld and Hatfield 2006). Put simply, it is difficult to rationalize the choice of habitat area to recommend as critical without the context of what the recovery goals and targets are. i.e. it is difficult to assess whether the area of habitat suggested as critical will achieve "survival or recovery" if recovery targets have not actually been stated up front. Clearer references to recovery goals and targets would strengthen the current rationalization of the area recommended as critical habitat. It might be worth looking at the Salish Sucker or Nooksack Dace critical habitat assessments to see how this is laid out.

Recovery targets can vary from:

1. a Minimum Viable Population (i.e. the smallest possible population that will survive in the long-term under environmental and demographic stochasticity) to
2. current distribution and abundance (which may or may not exceed a MVP) to
3. something considerably larger than a MVP (e.g. for a listed species with 8 isolated populations, a recovery goal that included protection of only one or two of those populations as a MVP could be considered minimalist, and a goal to protect a MVP within each popn. might be appropriate).

The Recovery Strategy for Morrison Creek lamprey states a recovery objective of "*Maintain a self-sustaining population of Morrison Creek lamprey within Morrison Creek.*" This objective is somewhat non-specific, and could be interpreted as a MVP. However, given the absence of any reliable information on population size let alone long-term viability, maintaining either a MVP or a self-sustaining population essentially defaults to an objective of maintaining current distribution and abundance, since this quantify of habitat is know to support the current population (assuming that it is stable).

Currently, the main rationale given for designating the entire stream as critical habitat is that the species is endemic, has a very limited distribution, and likely has a small population size (although the actual population size is unknown). This is fine, but it could be strengthened by reference to the recovery goals in the Recovery Strategy as noted above. i.e. if the stated goal is to maintain a sustainable population in the long term, and in the absence of any information on population size (but a default assumption that it is likely small) or any spatially-explicit knowledge of reach-scale locations and areas of habitat upon which the population depends (despite a general knowledge of the attributes of these habitats), then achieving the recovery target requires designating the entire stream. In effect, although not stated this way in the recovery strategy, the recovery target becomes maintain current distribution and abundance in the absence of specific information that indicates a smaller area will suffice, and the area of critical habitat becomes the current distribution as stated in the strategy.

An additional reason for identifying the entire stream as critical habitat (rather than subsets of it) is the inter-connected nature of stream habitats, and the sensitivity of habitat to upstream processes (again, see Rosenfeld and Hatfield 2006). Streams are dynamic, and habitat conditions at any location are highly dependent on upstream processes. Consequently, maintaining the integrity and function of the stream channel at a particular point requires

protection at a much larger scale. This is well reasoned in the last paragraph on Pg. 5 with reference to potential sensitivity of expression of the *marifuga* form to environmental triggers. The only useful addition might be that the "natural range of variation" of environmental factors is currently undocumented (and likely undocumentable in a practical sense), necessitating a designation of critical habitat that protects the overall integrity of the entire freshwater habitat in order to ***maintain*** the natural mean and range of variation (Rosenfeld and Hatfield 2006). Making this tie-in to maintaining overall channel structure more explicit would be a good idea.

4. Clearer justification for riparian as critical habitat

Although identification of riparian habitat as critical seems justified based on the ecology of lamprey, the rationalization for this could be strengthened. Although the assessment includes a useful overview of the general functions that riparian zones provide to streams (pgs. 11-12), being more specific about how impairment of those functions could negatively impact lamprey would be useful. In particular, it would be a good idea to more clearly note the potential negative impacts to lamprey of large changes in channel structure associated with alteration or removal of riparian vegetation; and that, as gravel spawners in riffles, they require clean subsrate like salmonids, making spawning and incubation success potentially sensitive to inputs of fine sediment. Inserting text to this effect would be useful, for example "*Removal or alteration of riparian vegetation can result in large changes to bank stability, channel dimensions, and sediment inputs (increased bank erosion and associated sediment), typically resulting in a wider shallow channel with a more mobile bed that may negatively affect the suitability of different life stages of lamprey to unknown degrees. In particular, lamprey spawn in clean gravel like salmonids, making them potentially vulnerable to the negative effects of sedimentation, as is well documented for salmonid species; removal of riparian vegetation has been widely associated with excess bank erosion and sedimentation that could potentially degrade lamprey spawning habitat.*" The author should refer to Richardson et al. 2010. This paper specifically deals with riparian in the context of critical habitat, and how to think about relating the functions of riparian to the biological attributes of the particular species in question (see their Table 1).

For "Key attributes" on page 12, I suggest expanding "*Stable banks*" to "*Stable banks that minimize bank erosion and sediment inputs that could degrade spawning habitat*".

5. 10m riparian buffer widths

On Pg. 6 it is stated that "Using the RAR method, it was determined that a 10 metre riparian buffer surrounding Morrison Creek and its tributaries would be needed...". The RAR methodology typically generates reach-specific width recommendations based on the particular attributes of a reach (see tables below extracted from "Anonymous. 2007. The technical basis of zone of sensitivity determinations under the detailed assessment procedure of the Riparian Areas Regulation. B.C. Ministry of Environment and Fisheries and Oceans Canada, Pacific Region. 55pp."). How was a single width of 10m arrived at? Some clarification here would be useful.

Table 1. Zone of sensitivity determinations under the B.C. Riparian Area Regulations for: (a) shade, (b) litter and terrestrial insect inputs, (c) large woody debris inputs and bank stability for streams, and (d) large woody debris inputs and bank stability for lakes and wetlands. Vegetation height classes are defined as: low cover ≤ 1 m < shrub ≤ 5 m < trees.

(a) Shade

Vegetation type	*Streams*	*Lakes and wetlands*
Low cover	n/a	n/a
Shrub	2 x width (maximum 5 m)	5 m
Trees	3 x width (maximum 30 m)	30 m

(b) Litterfall and terrestrial insect inputs for streams, lakes, and wetlands

Vegetation type	*Streams*			*Lakes and wetlands*
	Zone of sensitivity	*Minimum*	*Maximum*	
Low cover	5 m	5 m	5 m	5 m
Shrub	2 x width	5 m	15 m	15 m
Trees	3 x width	10 m	15 m	15 m

(c) Large woody debris inputs and bank stability for streams

Channel Type[a]	*Vegetation type*		
	Low cover	*Shrub*	*Trees*
Riffle-pool	3 times channel width to:		
	maximum of 5 m	maximum of 20 m	minimum of 10 m maximum of 30 m
Cascade-pool	2 times channel width to:		
	maximum of 5 m	maximum of 10 m	minimum of 10 m maximum of 15 m
Step-pool	1 times channel width to:		
	maximum of 5 m	maximum of 10 m	minimum of 10 m maximum of 10 m

(d) Large woody debris inputs and bank stability for lakes and wetlands

Vegetation type	*Zone of sensitivity*
Low cover	5 m
Shrub	5 m
Trees	15 m

[a] Channel types follow the "Channel assessment procedure field guidebook" (Anonymous 1996) of the B.C. Forest Practices Code. Note that the CAP definitions of channel types may differ from similarly-named channel types under other widely-used classifications (e.g., Montgomery and Buffington 1997).

1. Water quality parameters

Although "water quality parameters" are correctly identified in Table 1 as an attribute of critical habitat, it's always good to be more specific where possible. Presumably no detailed information is available for natural ranges of environmental variables in Morrison Creek or the tolerances of lamprey (nor would I suggest collecting this data in huge detail as it would be a

significant undertaking), but specific reference to provincial minimum water quality guidelines for aquatic life would be a good minimum bar (i.e. a minimum threshold for gross impacts to critical habitat as the water itself constitutes critical habitat). See section 2.2 of the Stickleback Species Pair Recover Strategy.

2. Potential for activities in the watershed to impact critical habitat

It might be worth inserting a paragraph somewhere highlighting the potential for activities in the watershed outside of potential critical habitat to impacts critical habitat (i.e. potential effects of urbanization or agriculture runoff on flow regime, water quality, etc.). To some extent this is buffered by the headwater wetlands, but ongoing urbanization may be an issue (?). Regardless, the point that activities outside of critical habitat (i.e. in the general watershed) may impact critical habitat, and that habitat management outside critical habitat may require management is an important one that should be noted somewhere.

Minor Comments

- pg. 6 – "*The proposed critical habitat described here is believed to be necessary for Morrison Creek lamprey* ***survival*** *in Canada.* " What is "survival"? Replacing this with "to achieve recovery objectives" may be more appropriate, provided that the recovery objectives are clarified early on in the document. As noted earlier, it is best to set the whole assessment up at the start in terms of the clearly identified recovery target/objectives.
- pg. 10 – "***CRITICAL HABITAT IDENTIFICATION IN RELATION TO POPULATION AND DISTRIBUTION OBJECTIVES*** *The recovery goal for Morrison Creek Lamprey is to secure its long-term viability within its natural range. The suggested critical habitat will support achieving this goal."* This section is short but good since it specifically relates the area of proposed critical habitat to the recovery goals. However, specific wording is important here. Is the recovery goal a Minimum Viable Population? Not as stated in the strategy; in retrospect, I think we avoided using the term "viability" in the recovery strategy because it has a specific meaning in conservation biology (typically, a Minimum Viable Population) and we wanted to avoid specifying the recovery target as a MVP (both because it is minimalistic, and because it is quantitatively very demanding to establish in terms of modelling and data needs). The wording here should therefore be cleaned up a bit, i.e. identify the recovery target/goal earlier on in the assessment, and then throughout the document try to be consistent with it.
- pg. 13 – Activities likely to destroy critical habitat –
- see suggested alterations in wording in CAPS below.
- Land-based activities which have the capacity to alter aquatic habitat directly (e.g. ~~impacts~~ REMOVAL OR ALTERATION OF ~~to~~ riparian habitat, alteration of run-off rates or water storage capacity in..."
- Activities that generate significant sediment inputs into MORRISON CREEK OR adjacent water bodies. Although turbidity THRESHOLDS SPECIFIC TO LAMPREY cannot be provided at this time, significant sediment influx into the stream could impair the osmoregulatory capacity of the animal OR NEGATIVELY IMPACT QUALITY OF SPAWNING HABITAT, AND SHOULD NOT EXCEED PROVINCIAL GUIDELINES FOR TURBIDITY AND SUSPENDED SEDIMENT IMPACTS ON AQUATIC LIFE. "However, if water flows are maintained within natural variability it is unlikely that the water course would dry up from deposition of sediment."THIS SENTENCE IS A BIT CONFUSING AND SHOULD BE STRUCK – SEDIMENT INPUTS COULD HAVE NEGATIVE IMPACTS WELL

BEFORE THEY WERE SUFFICENT TO INFILL THE CHANNEL AND CAUSE FLOW TO BE SUBSURFACE

References

Richardson,J.S., Taylor, E., Schluter, D., Pearson, M., and Hatfield, T. 2010. Do riparian zones qualify as critical habitat for endangered freshwater fishes? Can. J. Fish. Aquat. Sci. 67: 1197–1204